

Report as of FY2011 for 2011PA155B: "Understanding Municipal Officials Decisions to Lease Watershed Lands for Marcellus Shale Gas Exploration"

Publications

Project 2011PA155B has resulted in no reported publications as of FY2011.

Report Follows

PROJECT TITLE AND PRINCIPAL INVESTIGATORS

Understanding Municipal Officials' Decisions to Lease Watershed Lands for Marcellus Shale Gas Exploration

Charles W. Abdalla, Ph.D., Professor of Agricultural and Environmental Economics, Penn State University, University Park, PA

KEYWORDS

Marcellus shale, water quality, water quantity, gas drilling

STATEMENT OF WATER PROBLEM

Natural gas-rich Marcellus shale occurs below parts of Pennsylvania, West Virginia, Maryland, New York, Ohio, and Virginia (Figure 1). Its development as a potentially significant source of energy illustrates how energy policies and trends can drive changes in land and water use and public policies, including at the municipal level. The expanding demand for energy in the US, along with new drilling technologies such as horizontal drilling and hydraulic fracturing (“fracing”), have whetted mineral exploration companies’ interest in drilling into these gas reserves. Uncertainty exists as to how big the Marcellus shale gas play will become. The economic slump in 2008 slowed leasing activity. Nevertheless, leasing activity increased again in 2009, as did drilling and fracing of gas wells in Pennsylvania and also in West Virginia. Although the full impacts of Marcellus shale drilling remain to be seen, it appears that development of this shale is rapidly transitioning from an exploratory to a production phase in Pennsylvania and perhaps soon in additional states in the region.

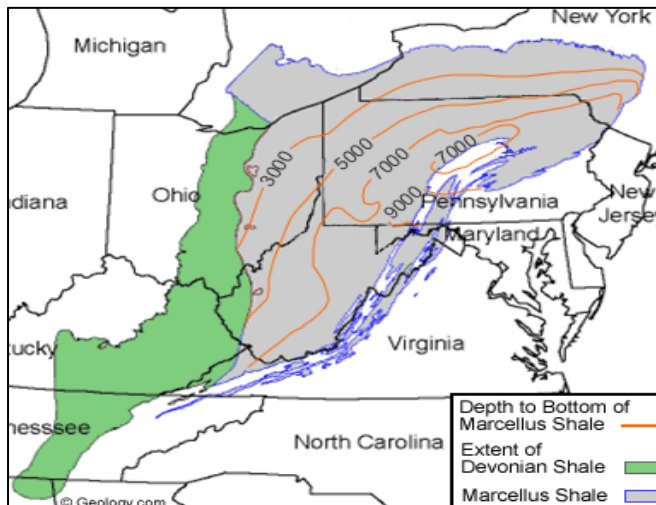


Figure 1. Location of the Marcellus Shale formation.
Source: Geology.com
<http://geology.com/articles/marcellus-shale.shtml>

Water is critical to extracting gas from the Marcellus shale. The shale around most new gas wells must be fraced to release the trapped gas so it can be brought to the surface. This process for a deep vertical well may use 500,000 to more than 1 million gallons of water. A

horizontal Marcellus well may use 3 - 4 million gallons of water. If the Marcellus is like other shale gas plays, some wells may need to be hydro-fractured several times over their productive life (typically 5–20 years). These large water withdrawals may have important watershed and ecological effects. The distribution of Marcellus shale within major watersheds of Pennsylvania in Figure 2.

The permitting, drilling and fracing of Marcellus gas wells has accelerated in the last two years. Pennsylvania's Department of Environmental Protection (PA DEP) issued about 2,000 new permits for Marcellus shale drilling in 2009. The agency is expected to issue about 5,200 permits in 2010.

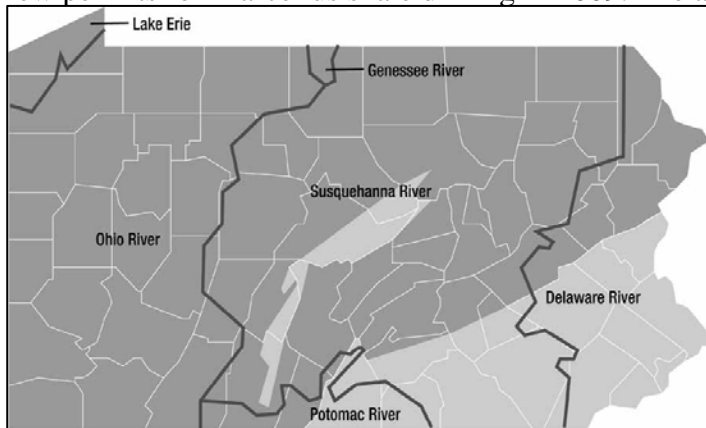


Figure 2. Distribution of Marcellus shale in Pennsylvania with major river basins overlain. Source: Abdalla, C., and J. Drohan. 2010.

The U.S. Geological Survey has identified described three major water resource concerns from production of gas from application of deep and horizontally drilling and fracing of the Marcellus shale in the Northeast and Mid-Atlantic Region. These concerns are: 1) supplying water for well construction without impacting local water resources; 2) safely transporting fluids and supplies avoiding degradation of small watersheds and streams as substantial amounts of heavy equipment and supplies are moved around on rural roads; and 3) determining proper methods for the safe disposal of the large quantities of potentially contaminated fluids recovered from the wells (Soeder and Kappel, 2009).

Water Supply. Thus far, most withdrawals in for Marcellus gas wells in Pennsylvania have been from surface water sources. Large withdrawals could also affect nearby drinking water sources and other uses. Putting water to one use may mean that it is not available for another use, thereby increasing the potential for conflicts between water users.

The Susquehanna River Basin Commission has estimated that at full development the total annual water withdrawal by drillers into the Marcellus shale in the basin will be about 10 billion gallons per year. While that amount may be manageable, environmental and water resource management agencies are concerned because gas wells are often in remote areas, where the closest water source may be an ecologically sensitive, small forested stream. Generally speaking, regional and state water managers played “catch-up” in 2008 and 2009 with the fast-moving industry after a number of water-related Marcellus shale drilling incidents. Several streams in Pennsylvania were dewatered for drilling and/or fracing.

Transporting fluids and supplies. An important challenge is to transport the large quantities of fluids and supplies without avoiding degrading watersheds and streams. Substantial

amounts of heavy equipment and supplies must be moved around on roads, many of them rural, in order roads to drill and frac a well. For example, some spills have occurred. DEP fined Cabot Oil and Gas Corp. \$56,650 for three spills totaling 8,000 gallons of a chemical used in the fracking process within one week in Dimock, Susquehanna County.

Wastewater disposal. An important challenge is the safe and economical disposal of the large quantities of potentially contaminated fluids recovered from the wells. Sand, gas, and chemicals are added to water used for fracing to extract gas. Wastewaters may also contain brine and other contaminants such as radioactive radon released from the underground rock formation. The chemicals used may include oils, gels, acids, alcohols, and various manufactured organic chemicals. Therefore, the storage, treatment, and return of these waste fluids to the environment are important water quality concerns. Wastewater fluids must be treated appropriately before disposal. Drilling and fracing water and other wastewaters are being transferred between river basins, and this may further complicate permitting and big-picture water management to ensure a consistent regulatory approach statewide. In addition, accidents involving trucks hauling wastewaters may degrade water supplies near roadways as well as create other problems.

Other environmental, health and safety concerns. Methane gas migration from Marcellus drilling in Dimock Susquehanna County, caused several private drinking water wells to explode and fouled nine other wells. Pennsylvania DEP says that for at least three Dimock wells, gas wells were improperly sealed during the early stages of drilling. This is not a new issue to well drilling in Pennsylvania, but it is new to Dimock and some other regions seeing Marcellus development. PA DEP is in the process of strengthening regulations governing the casing (lining to protect groundwater and allow the safe operation of the well) of Marcellus shale wells to protect groundwater.

The appeal to municipalities of leasing watershed lands. A 2008 survey by the Pennsylvania Sustainable Water Infrastructure Task Force found that Pennsylvania is facing nearly \$11 billion in unmet drinking water infrastructure needs. In addition, local public water suppliers were found to need significant money for ongoing operation and maintenance costs. The need for new investments is evidenced by the overflows, leaking and deteriorated collection systems, deferred rehabilitation and replacement work, and shortage of treatment capacity that plague the state's water systems. Because it is difficult to raise rates or taxes from customers or residents to cover these costs, some municipalities have become very interested in leasing mineral rights under watershed lands in regions of the state underlain with Marcellus shale. However, the uncertainty about the potential benefits and costs (environmental including water quality, and health and safety), make this a complex and often controversial decision. Much of the current information about municipal leasing of watershed land is anecdotal. To adequately educate and assist municipal leaders and their constituencies, greater documentation of such municipal activities, the motivations behind it, and leader's knowledge of possible impacts, is needed. This project seeks to fill that gap.

NATURE, SCOPE, AND OBJECTIVES OF THE PROJECT

The proposed project's main objectives are to increase understanding of a) municipal officials' motivations to lease mineral rights under their watershed lands; b) municipal officials' knowledge of the expected short-term and long-term benefits and environmental costs, particularly to water quality, of leasing watershed lands; and c) the processes used by municipal officials for balancing expected benefits and costs.

In addition, the knowledge base acquired from the project will be used to generate information for use in a broader research proposal, perhaps for the Northeast/Mid-Atlantic Region where Marcellus shale is located, and for dissemination to audiences through Extension/Outreach mechanisms and to professionals through presentations and publications.

PRINCIPAL FINDINGS AND SIGNIFICANCE

The principal findings relate to: 1) timing, 2) communication, 3) resources and networking, 4) monitoring water quality, and 5) balancing missions of providing safe affordable water with revenue from leasing watershed land. Opportunities for assisting municipalities considering leasing of watershed lands in the future are identified within each of the five areas below.

1) Timing. The timing of municipal decisions was found to be the most important variable affecting lease decision-making and outcomes. Municipalities approached earlier had less information and thus made relatively poorer decisions yielding less satisfactory outcomes. Municipalities that made decisions later and with more information based on their own or others' experiences, made better decisions. Extrapolating from this trend, we can expect improved decisions to result as more information continues to be spread about outcomes of leasing and shale gas drilling.

2) Communication. Improved communication among all parties will likely increase the level of trust surrounding decisions to lease municipally owned watershed lands. If trust increases, more informed decisions will result, and parties will be more satisfied with outcomes. Recommendations for improved communication include: a) Industry representatives should provide advance warning of their actions and respect municipality's property boundaries; b) Municipal officials should make as much information as possible available in a timely way to citizens through different means well in advance of decisions. Also, the credibility of information will be increased by involvement of neutral third parties; c) Given the complexity and rapidly changing nature of Marcellus shale development, citizens may need to be patient as they participate and give input to municipal decisions. Municipal officials may not yet have the information that citizen desire, or may lack control to implement options that some citizens desire.

3) Resources and Networking. Water providers' resources influenced their ability to make informed decisions about leasing. Smaller ones relied on communication with neighboring communities, expertise from training/educational organizations and/or grant resources from

state agencies and in-house staff and/or volunteers. Larger providers had more in-house staff and the wherewithal to purchase expertise to aid decision-making. Networking with neighboring communities was an important factor in learning about the shale gas exploration process, especially for smaller water providers that had been approached more recently. Three recommendations stem from the municipal resources/networking finding: a) Increased resources, possibly for training/networking and/or development of source water protection plans, would likely increase the quality of decisions of small and mid-sized water providers, b) Arrangements that allow more experienced systems to share expertise with less well-equipped suppliers directly or indirectly would increase the quality of decisions of small and mid-sized water providers, and c) Regionalization of systems may offer benefits of extending knowledge of watershed leasing although it is perceived by some to have costs as well.

4) Monitoring Water Quality. All municipalities studied indicated that they remained true to their mission of supplying adequate supplies of high quality water to customers. Due to this interest and the risks of water contamination from shale gas development, all saw the importance of water quality monitoring. Previously, some municipalities had not factored monitoring costs into their leasing decisions. The municipalities were in various stages of developing their water quality monitoring efforts, were using different approaches of different levels of sophistication, and funding sources, and had varied levels of experience to develop baseline measures of water quality. The following suggestions are made regarding water monitoring that government agencies and other organizations should: a) Increase their funding of regional or water quality baseline studies, b) Develop more training programs to do or improve baseline studies, and c) Encourage municipalities to include the full costs of water monitoring in leases; and d) Develop a more systematic protocol for collecting and analyzing water quality monitoring so that it is more consistent, credible and defensible.

5) Balancing missions of providing safe affordable water with revenue from leasing watershed land. The municipalities in the sample were confronted with the dilemma of wanting financial benefits from shale gas exploration while remaining true to their original mission of providing safe and affordable supplies of water to their customers. Complicating matters, most communities in the sample needed to replace aging water or sewer infrastructure. Often, their declining customer base and/or economic status prevented making these needed investments. The opportunity to lease watershed lands thus provides a way of obtaining revenues to cover these or other costs and assists the municipality. However, any unanticipated or uncovered costs of problems related to shale gas exploration, drilling or production, can reduce or even negate (especially if the costs are on-going), the revenues generated from leasing. Several recommendations flow from this finding: a) Municipalities should examine their mission statements to see how natural gas drilling fits into their organization's goals; b) Efforts should be undertaken by municipalities, or their state level professional associations, to identify and estimate in quantitative economic terms the impact of problems from shale gas development on their communities, including on consumer confidence, and the effect of water supply loss or water supply decline on community development.

Future research/outreach opportunities. Strengths of the study which could be followed up in future research included the: a) Analytical framework and the interview guide outline

derived from it; b) Relative ease with which common themes and findings were identified from a relatively small sample, c) Identification of lessons learned (e.g., networking, education) that are capable, in many cases, of being directly shared with other municipalities, and d) Ability to identify other key municipal decision variables (e.g., sales of water to the gas industry, funding of related infrastructure needs like wastewater systems both within and between municipalities, new methods of leasing such as electronic auctions, and water system regionalization).

Proposal Development. The following sources have been identified for follow-up research or outreach extension proposals: US Department of Agriculture's National Institute of Food and Agriculture-funded Mid-Atlantic Water Center for Rural Pennsylvania, the Heinz Foundation and the Colcom Foundation, regional offices of the US Geological Survey, and the Chesapeake Research Consortium/Scientific and Technical Advisory Committee of the EPA's Chesapeake Bay Program.

STUDENTS & POSTDOCS SUPPORTED

Renata Rimsaite, Agricultural Economics, Masters of Science, Penn State University
Patrick Boynton, Penn State U. Schreyer Honors College (undergrad), Bachelor of Arts

PRESENTATIONS

Abdalla, Charles W. "Municipal Roles in Water-Related Aspects of Shale Gas Development in Pennsylvania" Penn State Extension Marcellus Shale Extension Webinar Series, March 15, 2012, 92 participants.

<http://extension.psu.edu/naturalgas/webinars/recorded/municipalitys-roles-water-use-protections/charlie-abdalla-march-15-2012-powerpoint-2>

OTHER INFORMATION TRANSFER ACTIVITIES

An abstract for a presentation at the October 2012 Pennsylvania Planning Association's Annual Meeting and additional in-person and web-based Penn State Extension presentations are in development. An executive summary of the final report will be sent to interviewees, state or regional agency representatives that assisted with the research and other interested parties. During Summer 2012, a paper will be written for submission to a professional conference or refereed academic journal.